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end.

a second chamber for scanning said substrate with a linear laser light therein to conduct crystallization or activation on said substrate,

wherein said apparatus is provided with a means for transferring said substrate from said first chamber to said second chamber without exposing said substrate to air.--

REMARKS

This amendment responds to the Official Action mailed October 12, 1995. Filed concurrently herewith is a *Request for a One Month Extension of Time* which extends the shortened statutory period of response to February 12, 1996. Accordingly, applicant respectfully submits that this response is being timely filed.

Claims 8-23 and 27-29 were pending. In this submission, claims 8, 21 and 27 have been amended in order to more clearly define protection to which applicant is entitled. Claims 16-20 are cancelled without prejudice or disclaimer, and new claims 41-46 are submitted for examination on the merits. Accordingly, claims 8-15, 21-23, 27-29 and 41-46 are now pending in the present application and, for the reasons set forth below, are believed to be in condition for allowance.

SUMMARY OF THE INVENTION

The present invention relates generally to an apparatus for processing a semiconductor provided on a substrate without exposing the semiconductor to air between the formation of the semiconductor layer and the laser process. If the semiconductor layer is exposed to the air before it is processed with a laser light for crystallization, a natural oxide (SiO₂) is formed on the

semiconductor layer. During a laser crystallization, the natural oxide reacts with the semiconductor layer so that unstable silicon oxides (which may be expressed by SiO_{2-x}) are formed on the surface of the semiconductor layer. If a gate insulating film is formed on the semiconductor layer after the laser crystallization, there are many dangling bonds of silicon atoms at the interface between the semiconductor layer and the gate insulating layer. Accordingly, the characteristics of a semiconductor device using such a structure can not be improved. For the above reason, it is particularly advantageous to conduct a laser process after the formation of a semiconductor layer without exposing the semiconductor layer to air.

Specifically, claim 8 as amended recites an irradiation apparatus for irradiating a linear light to a semiconductor therein; a vacuum apparatus for vacuum processing; and a mechanism for transporting a substrate from the vacuum apparatus to the irradiation apparatus without exposing the substrate to air. Claim 21 further recites that the substrate is irradiated by a linear laser light passing through a light window provided on a wall of a light processing chamber, wherein the substrate is moved in a direction perpendicularly to the linear laser light in the light processing chamber to crystallize an entire semiconductor film provided on the substrate.

PRIOR ART REJECTIONS

The Official Action rejects claims 8-11, 13, 21-23 and 27-29 as anticipated by U.S. Patent No. 5,194,398 to Miyachi et al. This rejection is respectfully traversed in view of the amendments herein, and reconsideration is requested based on the following remarks.

The Official Action asserts that Miyachi et al. discloses an apparatus comprising a film forming chamber 1 for forming an amorphous semiconductor film and a dehalogenating-hydrogenating chamber 2 (see Fig. 5) which are combined by a conveying device 13 for moving the substrates between the chambers. The dehalogenating-hydrogenating process is performed using a light irradiation process (see col. 18, lines 29-43).

As noted above, Applicant has amended independent claims 8, 21 and 27 to include the feature of treating the semiconductor with linear laser light. Miyachi et al. does not disclose that a linear laser light is used during the light irradiation occurring during dehalogenation-hydrogenation. The Applicants have found, as described in the second full paragraph on page 8 of the present application, that using a linear laser light having a large-enough cross section enables the whole surface of the semiconductor substrate to be treated by the linear laser beam as the semiconductor substrate is moved gradually through the light processing chamber. This provides a more effective and time-efficient method of treating the semiconductor substrate with laser light since an entire linear width of the surface of the substrate can be treated with a linear laser light. This feature is absent from the Miyachi et al. reference. In view thereof, reconsideration of the above claims as amended is requested.

The Official Action rejects claim 12 as obvious based on the combination of Miyachi et al. and U.S. Patent No. 4,888,305 to Yamazaki et al. This rejection is respectfully traversed in view of the amendments herein, and reconsideration is requested based on the following remarks.

Miyachi et al. is applied as discussed above, and the Official Action asserts that Miyachi et al. lacks anticipation only of introducing the laser light through a window provided in the wall of the chamber. The Official Action

further asserts that Yamazaki et al. discloses an apparatus for photo annealing non-single crystalline silicon films in which light irradiation is carried out by irradiating the interior of a reaction chamber 11 with an excimer laser or the like through a window (see col. 2, lines 38-41). Therefore, the Official Action asserts it would have been obvious that the laser light used in the known method of Miyachi et al. could be introduced through a window provided in the wall of the dehalogenating-hydrogenating chamber thereby allowing control of the laser without exposing the substrate to air.

Applicant respectfully submits that claim 12 is dependent on claim 8 and therefore, should be allowable for all of the same reasons discussed above in connection with claim 8 with regard to Miyachi et al. In addition, the applicant believes that the Official Action has failed to provide a motivation for one skilled in the art to combine the above-noted prior art references to yield the present invention. Therefore, reconsideration in view of the above arguments is respectfully requested.

The Official Action rejects claims 8 and 14-20 as obvious over U.S. Patent No. 5,310,410 to Begin et al. in view of Miyachi et al., U.S. Patent No. 4,937,205 to Nakayama et al., U.S. Patent No. 5,200,017 to Kawasaki et al. and further in view of U.S. Patent No. 5,292,675 to Codama. This rejection is respectfully traversed in view of the amendments herein, and reconsideration is requested based on the following remarks.

The Official Action asserts that Begin et al. discloses an apparatus for processing semiconductor wafers which includes satellite reaction chambers disposed around the periphery of a central chamber which houses a robot assembly for moving a substrate to various positions within the apparatus (see Fig. 1). Nakayama et al. and Kawasaki et al. appear to generally teach

plasma doping apparatus and methods. The Official Action asserts that Codama discloses a method for fabricating a TFT using an etching and ion implantation process. Therefore, the Official Action asserts it would have been obvious in light of the semiconductor device process disclosed by Codama to include a light irradiation chamber, an etching chamber, and an ion introducing chamber in the known apparatus of Begin et al.

With respect to independent claim 8 as amended, none of the cited references disclose that a linear light is utilized to irradiate the semiconductor substrate. Therefore, the combination of prior art does not produce the claimed invention. In *In re Dillon*, 16 U.S.P.Q.2d 1897 (1990), the full Court of Appeals for the Federal Circuit held that in making an obviousness rejection, the Patent Office must make a prima facie case of obviousness, including both (1) a showing of structural similarity between one or more prior art references and the claimed invention, and (2) some specific motivation in the prior art references for combining the references in the manner asserted. Accordingly, since the combination of prior art does not produce the claimed invention, there has not been a showing of structural similarity between the prior art references and the claimed invention.

Applicants have found that using this linear laser light provides unobvious advantages over the prior art by providing a more effective and time-efficient method of treating the semiconductor substrate with laser light since an entire linear width of the surface of the substrate can be treated with a linear laser light. Therefore, one skilled in the art would not be motivated by the prior art to produce the claimed invention. Furthermore, Applicant believes that the Official Action has completely failed to provide a sufficient showing that one of skill in the art would be motivated to combine these

references as done in the Official Action. Absent some showing in the prior art that one of skill in the art should combine these references, Applicant believes that the rejection is improper and reconsideration is requested.

The Official Action provisionally rejects claims 8-20 under double patenting as claiming the same invention as that of claims 8-20 of co-pending application Serial No. 08/160,909. The Applicants respectfully disagree with the Official Action and reconsideration of the provisional rejection is requested. First, the Applicant notes that claims 16-20 of the present application have been cancelled. Furthermore, claim 8 of the present application and claims 8, 11 and 12 in the '909 application have been amended, and amended claims 8-15 of the present application do not claim the same invention as amended claims 8-20 of the '909 application. Reconsideration in view of the above amendments is requested.

The Official Action asserts that claims 8-20 of the present application are directed to the same invention as that of claims 8-20 of the commonly assigned co-pending '909 application, and further asserts that the issue of priority under 35 U.S.C. § 102(g) of this single invention must be resolved. As discussed above, claim 8 of the present application and claims 8, 11 and 12 in the '909 application have been amended, and amended claims 8-15 of the present application are not directed to the same invention as amended claims 8-20 of the '909 application. Reconsideration in view of the above amendments is requested.

The Official Action provisionally rejected claims 21-23 and 27-29 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 8, 10 and 11 of the co-pending '909 application. Claims 21 and 27 of the present application and claims 8 and 11 in the '909

application have been amended, and amended claims 21-23 and 27-29 of the present application are not directed to the same invention as amended claims 8, 10 and 11 of the '909 application. Therefore, Applicants believe claims 21-23 and 27-29 are patentably distinct over the claims of the '909 application, and reconsideration in view of the above amendments is requested.

FORMALITIES

The Official Action rejects claim 20 as indefinite. Specifically, the Official Action rejects the phrase "magic hand" used in line 1 of claim 20 because it is unclear. Applicants have here-in-above cancelled claim 20.

CONCLUSION

In each case, the pending rejections should be reconsidered in view of the amendments and remarks herein. Applicants believe that this case is in good condition for allowance, and a Notice of Allowance is earnestly solicited. If a telephone or further personal conference would be helpful, the Examiner is invited to call the undersigned, who will cooperate in any appropriate manner to advance prosecution.

Respectfully submitted,



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